Unmanned Aerospace Systems Working Group Policy Development Update

The development of unmanned aerospace systems is a rapidly evolving technology area. An evolution from drones and remotely piloted vehicles, these flight systems now encompass everything from hypersonic vehicles (shown right), to rotary wing hover systems (shown below), to lighter than air systems, and to any sort of hybrid imaginable – so long as the pilot is either not on board or the flight system is computer programmed.

These flight systems, with sizes ranging from housefly to full scale aircraft, are now being visualized for operations at all altitudes of the atmosphere and beyond and are much more than just flight hardware.

Formerly referred to as *unmanned aerial vehicles* and inclusive of unmanned aircraft systems, the rapid evolution of unmanned aerospace systems continues to blur, alter, or make obsolete definitions of flight systems as their capabilities evolve into and between the domains of air, space, and near-space.

Orbital, suborbital, and aircraft-like flight may possibly be integrated using combinations of ballistic, buoyant, or aerodynamic processes. As systems, these unmanned aerospace systems may include control stations, computers, human operators, remote sensing technology, communication and control links and relays, and Range Safety systems spanning the globe.

In 2005, the NASA Applied Technology Directorate, the NASA Range Safety office, and the United States Air Force 45th Space Wing Safety Office formed a working group to address the range support and Range Safety issues for such diverse systems operating near the launch head of the Eastern Range.

Development of Range Safety Requirements

A major technical thrust since 2005 has been the development of Range Safety requirements specifically designed to address the unique risks at the Eastern Range, especially for unmanned aerospace system operations near the launch head. Such challenges include rocket plume effects on unmanned aerospace system flight hardware, additional risks from unmanned aerospace system accidents impacting highly volatile rocket propellant facilities, and application of risk management principles for the safety of personnel and public in relatively close proximity.

To address these challenges, the working group conducted an extensive document review in 2005-2006 to aid in determining the compulsory subtopics to be addressed in a requirements document and a flight operations manual. Once completed, an exhaustive outline was formulated and sections were assigned to personnel to develop requirements based on subject matter expertise.

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The working group was further challenged to incorporate rapidly evolving operational concepts and current considerations for operating unmanned aerospace systems in the National Airspace. In 2007, this safety risk management process was significantly refined to also address mature operational unmanned aerospace systems.

In 2007, technical interchanges expanded to include the Air Force Space Command Future Range Architecture Team, the NASA advanced range technology community, and the Range Commanders Council Range Safety Group. Development of a customer oriented Kennedy Space Center-45th Space Wing concept of operations support process was initiated. In the midst of these developmental efforts, requests for unmanned aerospace system operations of varying maturities and risks were submitted to the Range causing accelerated attention to developing these unmanned aerospace system support processes.

Technical Challenges

Meanwhile, technical challenges remain. Of urgent significance is the need to consider alternative classifications of range safety systems or contingency management systems that can accommodate the diverse unmanned aerospace system operational situations that are quite different from rocket launch or piloted aircraft operations.

Depending on risks involved, such systems might be of several reliability classes. Such systems may be challenged to operate over short to very long duration missions, be relatively inexpensive for expendable operations or stamina for repetitive operations, possibly micro-miniaturized, or operate in environments spanning from Federal Aviation Administration controlled national airspace to remote operations in hostile combat arenas.

Presently the aviation community is addressing the concerns of allowing unmanned aerospace system flight operations alongside airliners. Some unmanned aerospace systems are rapidly maturing, but before they become as safe and reliable as piloted aircraft, technologies must further evolve; for example, attention must be paid to the following:

- A reliable means to "sense and avoid" other planes
- New air-traffic control systems based on electronic rather than voice communications
- The ability to address and resolve in-flight unmanned aerospace system anomalies

As unmanned aerospace systems continue to evolve, current definitions or paradigms for reusable launch vehicles, “fly-back” stages, and re-entering payloads from the ballistic launch community may need to be revised or melded. Paradigms of dedicated links and cyber systems for flight safety systems or flight control may soon be challenged by evolving network centric efficiencies supporting not only launch range, but also sustained unmanned aerospace system flight, and other operations yet to be considered.

Along with the robust evolution of unmanned aerospace system technology, robust requirements must also address the synergistic overlap and melding of space, cyber, and unmanned aerial vehicle communities. The unmanned aerospace systems working group is striving for operational robustness to protect personnel, property, other aircraft, and national assets, while enabling new flight systems to operate with appropriately managed risk.